

Activity of Praziquantel Against *Anoplocephala perfoliata* (Cestoda) in Horses

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ABSTRACT: Activity of praziquantel was evaluated against the tapeworm, *Anoplocephala perfoliata*, by a modified (24-hr) critical test method in 19 infected horses. The injectable formulation of the drug was administered by stomach tube (ST) or intraorally (IO). Removals were 89% to 100% (average of 98%) at 1.0 mg/kg (ST) ($N = 6$ horses), 100% at 1.0 mg/kg (IO) ($N = 2$ horses), and 82% to 100% (average of 91%) at 0.75 mg/kg (IO) ($N = 11$ horses). Toxicosis was not evident in any of the horses after treatment.

KEY WORDS: praziquantel, efficacy, tapeworm, *Anoplocephala perfoliata*, horses.

Anoplocephala perfoliata has been found in over 50% of necropsied Thoroughbreds in Kentucky in recent years (Drudge and Lyons, 1986). This species of tapeworm is generally located in the cecum around the ileo-cecal junction. Various detrimental effects attributed to this parasite include ulceration of the mucosa, edema, inflammation and blockage of the ileo-cecal opening, rupture of the cecum, intussusception of the ileum and cecum, and ileal hyperplasia and hypertrophy (Beroza et al., 1986; Drudge and Lyons, 1986; Edwards, 1986; Owen et al., 1989).

Currently, there are no drugs on the market in the U.S.A. labelled for removal of tapeworms in horses. Reports have indicated that pyrantel pamoate, which is commercially available as a nematocide, is efficacious, but activity is variable against *A. perfoliata* at the single (6.6 mg base/kg) and double (13.2 mg base/kg) dose rates (Lyons et al., 1974, 1986, 1989; Slocombe, 1979).

The purpose of the present study was to determine the efficacy of praziquantel against natural infections of *A. perfoliata* in horses.

Materials and Methods

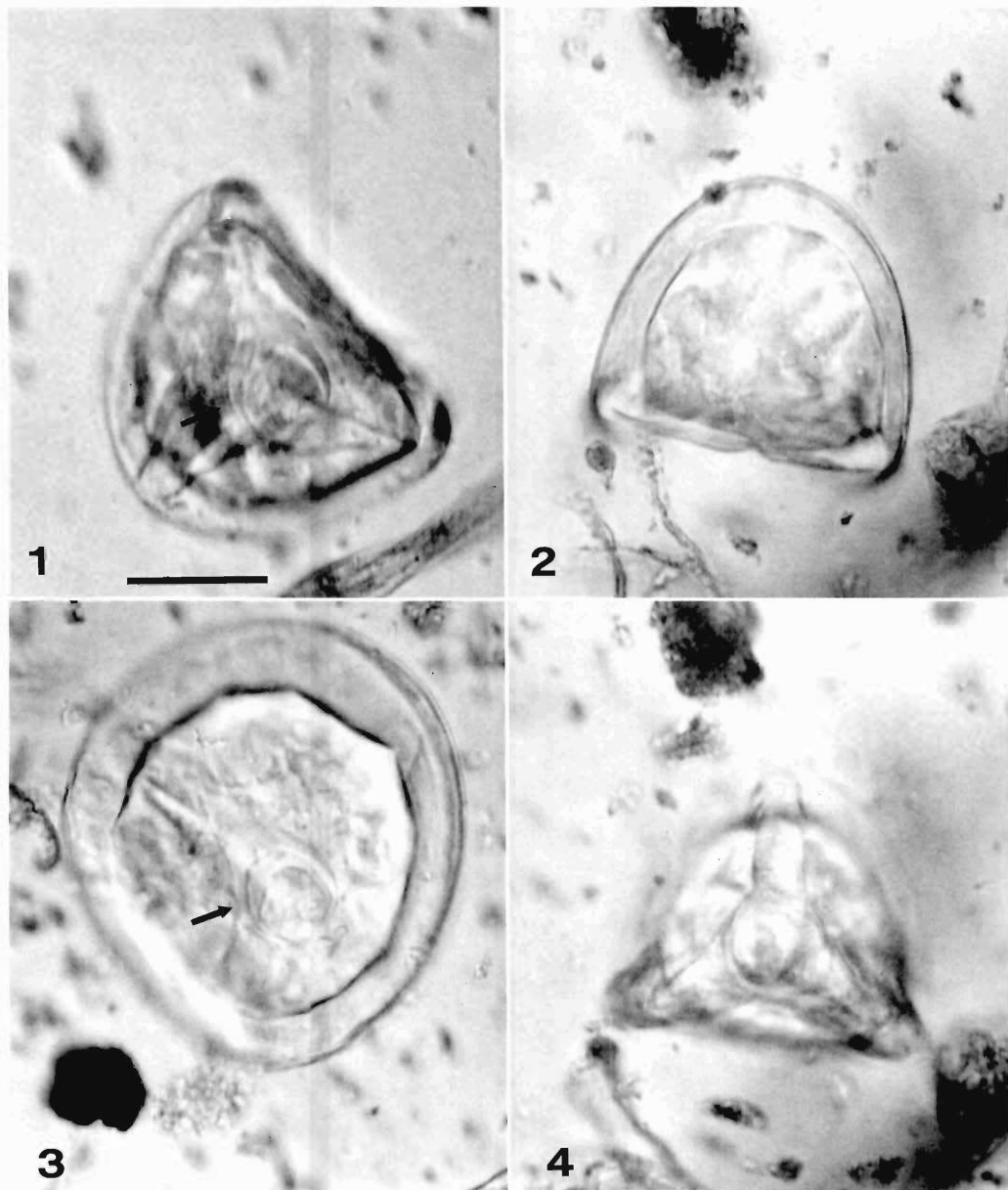
Techniques are deficient in detecting tapeworm eggs (Figs. 1-4) in feces of horses. For example, in 2 studies (Lyons et al., 1983, 1984) on dead Thoroughbreds, *A. perfoliata* eggs were found in feces by flotation with saturated NaCl in 3% of the horses (prevalence = 54%), and with ZnSO₄ in 7% of the horses (prevalence = 53%). In the present study, feces were not examined for *A. perfoliata* eggs before treatment of the horses because of the poor correlation with actual infections of tapeworms. However, it was presumed that, based on several recent prevalence studies in dead Thoroughbreds in Kentucky, about 50% of the test horses would be infected with *A. perfoliata* (Drudge and Lyons, 1986). Data (mostly on Thoroughbreds) indicated

no apparent differences in prevalence of *A. perfoliata* by sex or age of the animals (Lyons et al., 1983, 1984).

For the present investigation, 35 horses, 19 of which were infected with *A. perfoliata* at necropsy, were treated with praziquantel, 1 at a time as each was acquired, between 15 February 1988 and 2 October 1990, in critical tests. The horses were cull animals, donated by local farms because of physical problems, including leg deformities—several were wobblers. The majority of the horses were Thoroughbreds ($N = 32$); others were Standardbreds ($N = 2$) and mixed lighthorse-type ($N = 1$). Sexes included 17 males (intact), 4 geldings, and 14 females. Ages varied from <1 to 23 years; (<1 year = 2 horses; 1 = 18; 2 = 3; 3 = 1; 5 = 1; 7 = 2; 13 = 1; 14 = 1; 17/18 = 3; 20 = 2; 23 = 1).

The critical test method (Hall, 1917; Hall et al., 1919; Moskey and Harwood, 1941; Drudge and Lyons, 1977) is commonly used to determine efficacy of compounds against internal parasites of animals, particularly horses. Each animal serves as its own control. Typically, a count is made of parasites passed in the feces for several days after treatment and of those remaining inside the animal at necropsy to obtain the total number present at the time of treatment. From these data, efficacies are calculated.

In the present investigation, a modification (Todd and Brown, 1952; Lyons et al., 1986, 1989) of the basic critical test was used. Equids were euthanatized at 24 hr after treatment. Feces were not examined during this short posttreatment period. Details of this critical test modification have been described in 2 publications on evaluation of activity of pyrantel pamoate on *A. perfoliata* (Lyons et al., 1986, 1989). In these publications, mention is made that 1 advantage of this quick test is that horses are examined soon enough (24 hr) after treatment so the tapeworms, affected by the drug, generally have had time to be moved posteriorly from their normal location in the intestine, but generally have not yet been passed in the feces. This allows more accurate finding of intact specimens (particularly with scolices still attached) which tend to disintegrate soon after being affected by a drug. The normal location of *A. perfoliata* is in the cecum, but it is occasionally found in the small intestine and ventral colon. At necropsy, all specimens recovered from the small intestine and



Figures 1–4. Eggs of *Anoplocephala* sp. (probably *Anoplocephala perfoliata*) recovered from feces of horses by concentrated sugar flotation. Various views show the shape of the eggs as cupped (Figs. 1, 2), round (Fig. 3), and triradiate (Fig. 4). Arrows denote the oncospheres in Figures 1 and 3. Scale bar = 30 μ m for all photos.

cecum were considered not removed by the drug. Tapeworms found in other portions of the intestines—ventral colon (except for attached specimens), dorsal colon, small colon, and rectum—were considered removed by the drug. A total of all tapeworms found at necropsy 24 hr after treatment is the basis for calculation of efficacy.

Praziquantel injectable formulation (Mobay), currently marketed as a cestocide for dogs and cats, was

given once by stomach tube (ST) at 1.0 mg/kg to 7 horses, intraorally (IO) at 1.0 mg/kg to 6 horses, and IO at 0.75 mg/kg to 22 horses. Specific doses of drug for each horse were removed from the stock bottle with a plastic syringe and needle. The drug was expelled from the syringe (after the needle was removed) into a funnel attached to a stomach tube or IO directly into the mouth. Both the stomach tube and funnel were rinsed with about 300 ml of water to complete admin-

Table 1. Data on *Anoplocephala perfoliata* recovered at necropsy from 19 infected horses treated once with praziquantel.*

No. horses†	Drug		No. of specimens—range (mean)				Clearance‡	
	Dose rate (mg/kg)	Route or method of administration	Remaining	Removed	Total	% removal	≥90%	100%
6	1.0	ST	0–1 (0.17)	5–21 (9.7)	5–21 (9.8)	89–100 (98)	83	83
2	1.0	IO	0 (—)	6–7 (6.5)	6–7 (6.5)	100–100 (100)	100	100
11	0.75	IO	0–95 (12.7)	1–936 (131.6)	1–1,031 (144.3)	82–100 (91)	91	73

* Injectable formulation.

† Examination at necropsy was 24 hours posttreatment.

‡ Refers to the percentage of infected horses that had ≥90% removal and 100% removal.

ST = stomach tube; IO = intraorally.

istration of the drug. Efficacies of the 2 dose rates were compared statistically (*t*-test) for significance (Snedecor and Cochran, 1980). The injectable formulation was not administered parenterally. It was given only by ST or IO because of ease of administration and also to preclude adverse reactions (Campbell, 1972) sometimes associated with substances injected parenterally.

All horses were observed visually at varying intervals for toxicosis during the posttreatment period.

Results and Discussion

At necropsy, 19 (54%) of the 35 treated horses were found to be infected with *A. perfoliata*. Efficacy of praziquantel against *A. perfoliata* is presented (Table 1). Toxicosis was not evident in the horses after treatment.

For the 1.0 mg/kg dose rate (*N* = 8 horses), removal was 89% to 100% (average 98%) when the drug was given by ST (*N* = 6), and was 100% when administered IO (*N* = 2). Of the 6 horses treated by ST, removals were 100%, except for 1 horse that had 1 of 9 specimens remaining in the cecum. Praziquantel at the 0.75 mg/kg dose rate IO (*N* = 11) removed 82% to 100% (average 91%) of *A. perfoliata*. There was 100% removal in all but 3 of the infected horses, for which efficacies were 82%, 90%, and 91%.

Both dose rates had overall efficacious removal of *A. perfoliata*. There was no significant difference (*P* < 0.05) between the 2 dose rates. Possibly, this was because not enough tests were done to ascertain the validity of the small difference (8%) between means in the observed activities. Research should be pursued further to determine if even lower dose rates than 0.75 mg/kg of praziquantel are effective against *A. perfoliata*.

Prevalence of *A. perfoliata*, while 54% in all horses examined, was 59% in the 32 Thoroughbreds. The prevalence of this tapeworm species for these Thoroughbreds was similar to that (50% to 60%) found for over 1,000 necropsied Thoroughbreds in Kentucky in recent years (Lyons et al., 1983, 1984, 1986, 1987, 1989).

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Slide Available

Dr. Herman Zaiman has generously made available several copies of a 35-mm color transparency of *Hymenolepis nana* cysticercoids in mouse villi. The slide was prepared from a specimen donated by the late Dr. M. Yoeli and was photographed by Dr. B. Gueft. Members and other interested scientists who wish to obtain a copy should contact the Corresponding Secretary, David Chitwood, USDA, Nematology Laboratory, Building 467, 10300 Baltimore Boulevard, Beltsville, MD 20705-2350, USA.